Derby (R. H.)

PROGRESSIVE MYOPIA

AND ITS

OPERATIVE CURE.

BY

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PROGRESSIVE MYOPIA AND ITS OPERATIVE CURE.

It is not uncommon to hear from near-sighted people the belief expressed that their eyes are stronger than those that can see well in the distance. They are able to recognize very minute objects by weak light, and they congratulate themselves that at the time of life when others need a convex glass for reading, they will be able to work with ease without any glass.

How utterly without foundation this so generally-accepted prejudice is, I shall endeavor to show in the course of this paper.

We must distinguish between two forms of near-sightedness. The one has been called stationary, the other progressive myopia. In the former the near sight remains unchanged. With the proper glass, distant objects are seen distinctly, near objects are clearly seen without any glass, and the near-sight does not increase in degree. Indeed, between the fortieth and fiftieth year, when the power of accommodation becomes less, there is an apparent diminution in the amount of the myopia. These cases are the exceptions. The progressive myopia is a very different affection. It is a disease, and a disease fraught with many dangers to the eye. In the near-sighted eye there is more than a simple error of refraction. Its optical character may lie in this; its anatomical lies in a distention of the eye and increased length of its visual axis, and this depends upon

a pathological distention of its membranes. When this distention has reached a certain point, the membranes become attenuated, and their power of resistance so much diminished, that the distention no longer remains stationary, especially as the intraocular pressure in the myopic eye is generally increased. The myopia increases with this progressive distention, and *this is a real disease of the eye.*[1]

What are the dangers of high degrees of myopia? In the first place there is the tension of the inner membranes of the eye, and the ophthalmoscope shows the limited crescent at the border of the optic disk, but in many cases we see other changes that are not to be explained as the results of tension; small isolated patches lie about the disk—evidences of choroiditis. These circumscribed patches appear in the region of the macula lutea, sometimes only changes in the choroidal pigment, but often in the form of hæmorrhages presenting the appearance of a chorio-retinitis circumscripta, and in these cases the patients can no longer read as before; objects appear of an irregular form, and a central scotoma soon follows. Later opacities appear in the vitreous humor, and, if these are diffuse and become organized, there is great danger for the eye. Opacities in the lens occur too, and the saddest and unfortunately not an infrequent fate of these eyes, separation of the retina and subsequent blindness.

One word with regard to the frequency with which this affection occurs, before we pass on to a consideration of the conditions of its development.

Dr. Cohn, of Breslau, published in 1867 the results of an examination of the eyes of 10,060 school-children. He found a constantly-increasing number of myopic pupils from the lowest to the highest schools. The following table gives the percentage of near-sighted pupils in the various schools:

Elementary school	6.7 per cent.
Intermediate school	10.3 "
High-school (Realschule)	19.7 "
Colleges (gymnasia)	26.2 "

In the high-schools one-half of the first class were found to be myopic.

[1] Donders, "Refraction und Accommodation des Auges," p. 288.

In the colleges the statistics were more dreadful. Here in the sixth class 12.5 per cent. of the pupils are near-sighted, while in the first class there is the enormous percentage of 55.8 of myopic students.

Lately, Erismann[1] has published carefully-prepared statistics of the refraction of pupils in the schools of St. Petersburg. Four thousand three hundred and fifty-eight scholars were examined. Of these 30.2 per cent. were myopic. Here, as in Cohn's tables, a comparison of the different classes shows a startling increase from year to year in the number of myopes. Among children of eight years of age, 10.2 per cent. were found to be myopic. Among the pupils of twenty years, myopia was found in 40 per cent. of all examined.

The value of these statistics, taken from so large a number of pupils, must not be underrated. They establish the fact of the very great frequency of myopia, and show in most alarming figures the rapidity of its progress.

Let us now consider the factors concerned in the development and progress of myopia. We are told[2] that these are:

1. Pressure of the muscles on the eye during great convergence of the visual axis.

2. Increase of the intraocular pressure, produced by accumulation of blood in the eye through bending the head forward.

3. Conditions of congestion in the fundus, which lead to softening of the tissues, and even when the intraocular pressure is normal, but still more when it is increased, produce distention of the membranes.

The most potent of these factors is undoubtedly the first. Coccius[3] regards the convergence of the visual axis as a most important element in the development of myopia. He says: "The external muscles may give the eye a somewhat different shape at the same time that the ciliary muscle is engaged in accommodation." Giraud Teulon[4] considers that the act of convergence alone in the horizontal plane must through mus-

[1] "Archiv. f. Ophth.," xvii., 1, pp. 1–79.

[2] Donders, "Refraction und Accommodation des Auges," p. 288.

[3] Coccius, p. 87.

[4] *Annales d'Oculistique*, November, December, 1866.

cular pressure increase the intraocular pressure, and especially would this be the case where there was insufficiency of the internal recti muscles. The staphyloma posticum he regarded rather as an evidence of the insufficiency than of the myopia.

One word with regard to the relation between this insufficiency of the interni and the increase of the myopia. If the insufficiency exists for all points of the visual range, the muscle of accommodation is never at rest. On examining binocularly the degree of the myopia of such a patient for the distance, we find it too great, and not until either the muscular equilibrium is restored by aid of a prism of abduction or one eye is closed do we obtain the actual degree of the myopia. As Von Graefe[1] further points out, this apparent increase of the myopia through the muscular insufficiency is entirely analogous with what we find in latent hypermetropia—it is a limitation of the range of accommodation. Just as the prism with its base inward sets free a portion of the accommodation for binocular vision, so we need not be surprised that the patient who has formerly used concave 12 in order to see distinctly in the distance, after the tenotomy sees just as well with concave 14, 16, or even 18.

Von Graefe[2] considers insufficiency of the interni a most important factor in the progress of the myopia, and pointed out most clearly the beneficial action of a tenotomy of the external rectus in these cases. In a very large proportion of the cases of progressive myopia, perhaps in nine-tenths of all the cases, there is insufficiency of the interni, and, in an operation for the relief of the muscular difficulty, we are assured that we have a means of preventing the further increase of the myopia. How great an advance such an operation as this would be, needs but a moment's reflection. If, by a simple tenotomy, we can, besides relieving the very distressing symptoms of muscular asthenopia, moreover prevent any further increase of the myopia, does it not deserve our most earnest attention? We have endeavored to depict some of the dangers to which

[1] Zehender, 1869, p. 230.

[2] "Ueber die Operation des dynamischen Auswärtsschielen, besonders in Rücksicht auf progressive Myopie." *Klin. Monatsblatter für Augenheilkunde*, vii., August and September.

the near-sighted eye is liable. We have seen that such an eye is exposed to a chain of lesions that terminates not infrequently in blindness. Experience has shown us that in nearly all of these cases of progressive myopia there is an insufficiency of the internal recti. Many of the most acute observers have regarded this insufficiency as the most important factor in the development of the myopia, and one has gone so far as to call the staphyloma posticum the evidence of the insufficiency of the interni.

Let us now see what evidence there is in favor of tenotomy in these cases, and how far experience has shown that it has fulfilled what its advocates have claimed for it. Let us refer again to the previously-cited article of Von Graefe. Out of eighty cases of progressive myopia after tenotomy of the externus, only six remained markedly progressive, and four slightly so. All of these eighty cases were such as in the last two years before the operation had grown decidedly worse: for example, an increase of the myopia from $\frac{1}{7}$ to $\frac{1}{4.5}$, from $\frac{1}{24}$ to $\frac{1}{10}$, from $\frac{1}{12}$ to $\frac{1}{5}$. These were all cases observed during a period of at least four years.

In a recent number of Von Graefe's "Archiv.," Mannhardt publishes two cases of progressive myopia, in which the arrest of the disease after tenotomy was very marked. The first case was one of a girl ten years of age. The myopia of the right eye was $\frac{1}{27}$; of the left eye, $\frac{1}{50}$. Six months later, myopia of the right eye $\frac{1}{14}$; of the left eye $\frac{1}{30}$. Six months after this the myopia had increased to $\frac{1}{9}$ on the right eye, and $\frac{1}{18}$ on the left. There was marked insufficiency of the interni. The power of abduction was represented by a prism of 11°. A tenotomy of the right externus, and a month later of the left, was made. Three months after operation, the myopia, which had been so steadily increasing before, was now found to be only $\frac{1}{14}$ on the right eye, and $\frac{1}{27}$ on the left, and decreased steadily afterward.

In the second case, patient twenty-nine years of age, on the right eye myopia $\frac{1}{4}$; on the left eye $\frac{1}{12}$. There was facultative divergence of 6°. Tenotomy of the left externus was made. Fourteen days after operation, the myopia of the left eye was $\frac{1}{16}$. Four weeks later it was $\frac{1}{20}$, and at the end of ten

weeks it was $\frac{1}{24}$. The myopia of the right eye was reduced from $\frac{1}{4}$ to $\frac{1}{5\frac{1}{4}}$. In the course of his paper on this subject, Mannhardt states his conviction that the inflammatory processes which we call sclero-choroiditis posterior, with all their consequences, that the myopia itself, at least the progressive form, owe their origin to a purely mechanical cause, which we can correct or completely overcome.

The following five cases, all of progressive myopia, and in all of which a tenotomy of the external rectus was made to stay the disease, I have selected from my own records:

Case I.—Sigismund Wroblewski, twenty-five years of age, student of philosophy. Latterly myopia markedly progressive. Right eye, myopia $\frac{1}{3}$, v. $\frac{3}{4}$; left eye, myopia $\frac{1}{4\frac{1}{2}}$, v. $\frac{1}{2}$. Insufficiency of the interni, in 10″, of more than 18°. Insufficiency of interni, in 15′, of 9°.

Prism of abduction 18°.

On November 30, 1869, the right externus was cut. No suture was applied.

On June 11, 1870, a tenotomy of the left externus was made, and a suture, to limit the effect, inserted. A subsequent examination of the refraction showed no increase in the myopia. The muscular asthenopia was relieved, and patient received concave prismatic reading-glasses.

Case II.—Felix Gerloff, aged twenty-one. Right eye, myopia $\frac{1}{2}$, v. $= \frac{1}{3}$; left eye, myopia $\frac{1}{2\frac{1}{4}}$, v. $= \frac{1}{2}$.

In 8″ insufficiency of interni of more than 22°.

In 14′ insufficiency of interni of 10°.

Prism of abduction of 10°.

January 6, 1870.—A tenotomy of the right externus, with a suture to limit the effect, was made. Six months later, on June 2d, the myopia of the right eye was found to be the same; that of the left was $\frac{1}{3}$.

Case III.—Marie Zalenska, seventeen years of age. Myopia of right eye $\frac{1}{3\frac{1}{6}}$, v. $= \frac{3}{4}$. Myopia of left eye $\frac{1}{5}$, v. $= \frac{1}{2}$.

In 8″ dynamical divergence of 18° and more.

In 10′ dynamical divergence of 9°.

After correction of a slight difference of height in the two eyes, prism of abduction found to be 10°.

May 18, 1870.—A tenotomy of the left externus, with a

limiting suture, was made, and on the 18th of June a partial tenotomy of the left superior rectus.

June 25th.—Myopia remains the same as before the operation.

Case IV.—Ernst Siegfried, student, seventeen years of age. Latterly rapid increase in the myopia, which is now on the right eye, $\frac{1}{6}$, v. $= \frac{1}{2}$; left eye, myopia $\frac{1}{7}$, v. $= \frac{1}{4}$.

In 8″ insufficiency of interni of 12°.

In 10′ insufficiency of interni of 2°.

Prism of abduction 12°.

May 28, 1870.—A tenotomy of the left externus, with limiting suture, was made. Patient subsequently received weak concave prismatic glasses for his work, and the myopia remained the same as at the first examination.

Case V.—Hermann Simon, weaver, aged eighteen years, came to the clinique on account of rapidly-increasing near sight. Had never worn a glass.

On both eyes myopia $\frac{1}{3}$, v. $= \frac{1}{5}$.

In 6″ insufficiency of the interni of 10°.

Prism of abduction, after correcting a difference of height in the two eyes, 14°.

July 4, 1870.—Tenotomy of the left externus was made, and a limiting suture inserted. Patient subsequently received concave glasses No. 6 for his work. A later examination of his refraction was not made.

How is it that an operation that promises so much should not have been generally adopted and found its proper place in operative surgery? One reason for this has undoubtedly been the fact that neglect of the rules for the regulation of the effect of the operation has caused either real convergent strabismus or a most troublesome and persistent temporal diplopia, and, in consequence of this unfortunate issue, a distrust has grown up in the minds of the surgeons who have practised this measure.

That there is no danger of an excessive result from the operation if the effect of the tenotomy is accurately measured, my own experience and the careful observation of a large number of cases, operated upon by my late teacher, Von Graefe, have taught me.

I propose now, as briefly as possible, to review the method of examination of these cases, and indicate the precautions to be taken both at the time of operation and during the subsequent treatment.

The first and most commonly-employed test consists in directing the patient to fix with both eyes an object, which is advanced on the median line, until the nearest point of binocular fixation is ascertained. The power of maintaining binocular fixation for a near object is no proof that there is no insufficiency of the interni, for the punctum proximum is the result of fusion, and in cases of most marked dynamical divergent squint the punctum proximum is often excellent. The examination of the binocular near point reveals real relative divergent strabismus, if that be present, but the dynamical condition of the lateral muscles must be ascertained by other means.

Another test consists in momentarily interrupting binocular vision by covering one eye, and then watching the rotation that the eye makes while under cover, as well as the rotation required in order to regain fixation when the screen is removed. The great difficulty in measuring slight excursions of the eye prevented this test from fulfilling all the demands made upon it.

The last and conclusive test for insufficiency consists in interrupting binocular vision by means of a prism, with its base directed upward or downward. This, Von Graefe called the test of equilibrium. The prism thus held produces of necessity vertical diplopia. Every effort at fusion now ceases, and the dynamical condition of the lateral muscles now manifests itself. Dynamical divergence shows itself by a crossed position of the images, and the prism that is required to bring these images on the same vertical line represents the amount of the insufficiency for a given distance. We first measure this amount for the reading or working distance, to ascertain whether strong efforts at abduction are necessary. The usual test consists of a dot, through which a vertical line is traced. The patient's attention is directed especially to the dot, and the fine line serves to aid him in his estimate of the lateral distance between the dots. Having measured the amount of the disturbance of equilibrium for the ordinary working distance by means

of a prism with its base held vertically, the same test is applied to greater distances, and finally for fifteen feet. At this distance it is customary to substitute for the point a candle-flame. The amount of the disturbance of equilibrium for this distance is measured in the same way as before.

Before proceeding further it is proper to consider for a moment this test. Is it sufficient? Can we by this means detect ordinary cases of insufficiency of the internal recti, and measure the degree of such insufficiency? To this we answer unhesitatingly, Yes. This method of examination has been criticised, and the infallibility of the tests questioned. We believe that, by a careful application of the principles so distinctly enunciated by Von Graefe, these tests will prove in nearly every case sufficient. Von Graefe especially insisted that, in the examination of the insufficiency for the reading distance, the line should be, relatively to the point, very fine, otherwise the patient's attention would be occupied with the double images of the lines, and he would therefore make constant efforts to fuse the two lines in one vertical plane. Of course, if such efforts at fusion are made, the value of the test is lost. But, as Von Graefe points out, we have a means to detect this effort to fuse. This consists in giving the prism a slight inclination toward the one side or the other. If, when the prism is held before one eye, with its base downward, the patient sees two superimposed dots lying on one and the same vertical line; then, on turning the prism in the least about the visual axis, if no efforts at fusion are present, the dots will cease to lie in a vertical plane. If the base of the prism in this case is turned toward the temple, there will be crossed diplopia; and, if toward the nose, homonymous. If, however, efforts at fusion are still made, then the inclination of the base of the prism will have no other effect than to diminish the vertical distance between the dots. "Whenever the inclination of the prism does not change the lateral distance between the two points, that is to say, when the two dots appear upon one line, not merely in one position of the prism, but continue so while the inclination of the base is changed, then the test proves nothing." In order to avoid this disposition to fusion, Von Graefe advised in this test the use of a figure where the dot was larger

and the line very fine, directing the attention of the patient especially to the dot. If efforts at fusion were still made, then the figure was used where the line was very short, or a simple dot alone. Von Graefe mentions further exceptional cases where the minds of patients are so occupied with the idea of vertical contour, that even for the double images of a single dot they make efforts at fusion. In such cases he advises using a figure where the dot is very fine, or to substitute for the dot a short oblique line, and, while the test is applied, of turning the paper on which the line is traced.

Having now ascertained the degree of the insufficiency for the ordinary working distance, as well as for the distance, we must determine the power of abduction. As we shall see, unless this power of abduction or facultative divergence exceeds a certain limit, a tenotomy of the externus is out of the question. With marked insufficiency of the interni for the reading distance, we may find, for an object held fifteen feet away, no trace of dynamical divergence—indeed, there may be dynamical convergence; but still, if the power of abduction be good, there is no contraindication to the operation. Is it a disadvantage to have for vision in the distance an overbalance of the internal recti? No. The postulates for vision in the distance are no longer the same as for a nearer point, the visual act is not so fixed, is more transient. This negation holds as long as the patient does not really squint, so long as the overbalance is merely dynamical. Then, the first question to be answered, before we think of an operation to relieve the insufficiency, is, What is the power of abduction for the distance? What prism with its base inward can be overcome by divergence? This amount of ability to abduct we can remove. If this amount be less than what is represented by a prism of 8°, an operation is out of the question.

In seeking the prism which for the distance can be overcome by facultative divergence, great care must be taken that too strong a one is not chosen. Want of practice on the part of the patient, exclusion under the prism, an actual difference in height of the two eyes, may lead us in one case to choose too strong, and in the other too weak a prism. If the power of abduction in proportion to the disturbance of equilibrium, as

found by the equilibrium test, appear very small and below the amount (8°) required to admit of operative interference, it is then often desirable to prescribe the abduction prism overcome to be worn by the patient for the distance for some time. Frequently, then, after a few hours, the power of abduction increases by 2° or 3°, and after two or three days by 4° or 5°, and then we obtain a facultative divergence of the amount required, its absence in the first instance being due alone to want of practice. Care must be taken that the double images stand each in the same horizontal plane. If they do not, it may be accomplished by a slight rotation of the prism, and then the facultative divergence will be found greater than was supposed, one image standing higher than the other having previously made fusion difficult. This difference in height may have arisen from the surgeon not having held the prism strictly horizontal; sometimes, however, in these cases, besides the disturbance in the lateral equilibrium, there is one in which the recti superior and inferior are concerned, causing the difference in height of the double images. As soon as this difference in height is corrected, and the double images brought upon the same horizontal plane, it will be found that a stronger prism can be overcome. I have in mind a case where there was progressive myopia of a $\frac{1}{6}$ on one eye, and $\frac{1}{36}$ on the other. Insufficiency of the interni, in eight inches, of more than 18°. An insufficiency, in ten feet, of 9°. The strongest prism that could be overcome for the distance by divergence was 5°–6°. Much as the operation was indicated with this small amount of facultative divergence, it was impossible. A careful examination showed that the left eye stood higher than the right, and upon correcting this difference of height by means of a prism of 4° (base downward), a power of abduction represented by a prism of 10° was developed. Tenotomy of the externus was now made, with a limiting suture, and subsequently a partial tenotomy of the left superior rectus. The insufficiency was much relieved, and binocular vision secured.

Care must be taken that the patient does not exclude under the prism. To be assured against this error, it is not sufficient that, with the least rotation of the abduction prism, diplopia appears; because patients who are in the habit of peri-

odically excluding, as is often the case, find it easy to do so for images which lie in the same horizontal plane, but not when a slight difference in the height of the image is induced; nor is it sufficient that the next strongest prism produces homonymous diplopia, for it often happens that for certain excentric positions the patients exclude, and not at either side of this. The only method of finding if the patient excludes with one eye is to cover each successively with a screen. If, on doing so, the covered eye remains in the same position as previously, we may know that there is no exclusion active; if, on the other hand, one of them makes a slight rotary motion, the contrary is true.

On which eye is the tenotomy to be performed? As a rule, we may say on that eye which first deviates outward on approaching the fixation object, or it is to be performed on the eye with the strongest facultative divergence, or on the one with the worst acuteness of vision.

If the insufficiency of the interni is considerable, represented by a prism of 14° or 16°, then it is most desirable to divide the effect of the operation between the two eyes, making successively a tenotomy of each externus, and limiting such effect, as we shall see presently, by the conjunctival suture.

The proportioning of the operation to the effect desired is of the utmost importance, and a neglect of this will leave the patient in a much more unhappy condition than before the operation. Inaccurate measurement may leave the patient with a most distressing diplopia. The following rules for regulating the effect of the operation, based upon his own experience, I give in Von Graefe's own words. A simple tenotomy of the externus produces an effect equal to that of an abduction prism of 16°; accordingly, with a facultative divergence of 15°, 16°, 17°, or 18°, a simple tenotomy is performed. For one of 14° and less, a restricting suture must be applied. This suture, by drawing the edges of the conjunctival wound together, prevents the too great retraction of the muscle. Its effect depends on its direction (horizontal), on the amount of conjunctiva it contains, and on the closeness with which it is tied.

If the abduction prism = 14° or 13°, a slightly horizontal

suture is to be applied, containing on each side one line of conjunctiva, and it is to be tied so as barely to close the wound. If 12° or 11°, then a moderately horizontal suture, containing about one line on either side, the wound to be closed. If 10°, a moderately horizontal suture, containing about one and a half line, the wound to be closed. If only 9° or 8°, the suture is to be applied as horizontally as possible, is to include two lines of conjunctiva on either side, and the edges are to be drawn tightly together. If the abduction prism amount to more than 18°, it is best to divide the operation between both eyes.

Immediately after the operation, the effect must be controlled by means of the equilibrium test, made in what is called the "position of election." The position of election lies about ten feet from the eyes, about 15° toward the side of the unoperated eye, and 15° below the horizontal plane in which the orbital axes lie. Experience shows that in this position the immediate effect and the ultimate effect bear a much more constant relation to each other than in the median line. In the latter place the transitory operative effect comes too much into play.

In this position of election now there must be, immediately after the operation, equilibrium. If we find in this position 1° to 2° of divergence that gradually passes over to a slight convergence in the middle line, and a strongly-pronounced convergence as the object is moved over to the side of the operated muscle, we may be fully contented. Never, however, should we leave in the position of election a convergence of more than 3°, for then there is danger of strabismus, convergence, and diplopia ensuing. Should the equilibrium test not show a condition in accordance with these rules, an immediate change in the suture must be made.

With attention to these rules, a real convergence with diplopia in the median line may be avoided, but they do not afford protection against temporal diplopia toward the operated side. In order to avoid this, the defect of absolute motion produced by the operation must be subjected to control. A defect of motion toward the operated side of more than three lines must never be allowed to remain, but must be mod-

erated by a suture. If the measure of the operation was high (> prism 14°), a defect of $2\frac{1}{4}$ to $2\frac{1}{2}$ lines may be left; if the measure was less than this, a defect of motion of even two lines must be moderated. A defect of $1\frac{1}{2}$ line may be left, even with small measures of operation (8° to 9°) without any danger, always provided the demands in the position of election are supplied. Should the correction of the defect of motion materially influence the result of the equilibrium test, this dilemma may be avoided by a subsequent operation on the other eye.

If the condition be examined six or seven hours after the operation, a slight increase in the effect will be found in the position of election. Instead of dynamical equilibrium, slight (1° to 2°) dynamical convergence will be found. This convergence increases until the fourth day, when it amounts to 3°, 4°, or 5°, and in the median line from 8° to 16°. According to their greater or less power of fusion, the patients see double on the other side of four or three feet, or even one and a half foot in the median line. This increased effect increases again from the fifth, sixth, or eighth day, so that the diplopia in the median line disappears, mostly in the second, or at latest in the third week, and the lateral diplopia to the side of the operated eye some weeks later. The defect of absolute motion usually remains the same for some days after the operation, and then gradually decreases until, two or three weeks afterward, it only amounts to half, and, in some months later, the quarter of its original amount.

As to the after-treatment, the operated eye is to be bandaged, in order that as far as possible no movement of the eye shall modify the immediate effect. If a suture has been used, the patient must be seen within six or eight hours after the operation, and the equilibrium test made in the position of election. Should the effect now be found greatly increased, either from the suture having come out, or through tearing of the conjunctiva at the point of puncture of the suture, a new one must be put in place which will restore equilibrium in the position of election. On the other hand, if now we find the effect reduced (a thing that sometimes happens through an ecchymosis occurring after the bandage was applied, or through

swelling of the portion of conjunctiva contained in the suture), and if this reduction of the effect is as great as 5° or 6°, it must be corrected. At the end of twenty-four hours after the operation, the suture has established its effect, and may be removed. If at this period too great an increase in the effect be found, corresponding to a prism of 6° or 7°, then a new suture must be applied, which shall secure equilibrium in the position of election. If there be no increase in the effect of the operation, then the suture is to be removed, and the patient directed to look to the side of the unprotected eye, by which means the still delicate adhesions will be stretched, and the operative effect increased.

On the second day much the same principles are to be observed. If there be dynamical convergence of 2° to 4° in the position of election, there are no measures to be taken. If dynamical convergence of 7° or more, a new suture is to be applied, and the adhesions loosened. If there be dynamical equilibrium, then the eyes are to be directed strongly to the side of the unoperated eye, and this can be best accomplished by means of the ordinary squint-spectacle, with its opening outward and before the healthy eye. If there be dynamical divergence, and the suture still in place, it is to be removed, and an horizontal suture, inside of the cornea, containing a large fold of conjunctiva, applied.

If, in the course of the next few days, between the third and the sixth, it becomes necessary to increase the effect, the patient must be directed to persistently look toward the side of the unoperated eye. Should it now be necessary to diminish the effect (an increase of 5° or 6° may be left so), the edge of the wound must be raised, the attachments separated, and a more effective suture applied.

In the course of the second and third weeks after the operation, a decrease in the effect usually appears. Should this decrease not prove sufficient, then associated movements toward the side of the operated eye are to be advised. Toward the end of the second week, if the effect is to be diminished, the patient should receive the strongest possible prisms of abduction for reading. If, on the other hand, an increase in the

effect is desired, a combination of concave glasses, with prisms of abduction, should be worn for the distance.

In the foregoing rules for the management of the operation, free use has been made of Von Graefe's original articles, and Dr. Swanzy's excellent *résumé* of the subject in the *Dublin Quarterly*.

I cannot leave this subject without urging upon my readers, and especially upon such as are interested in ophthalmic medicine, the great importance of this operation as a prophylactic measure in progressive near sight. It may be said that we shall have to operate upon a large class of cases where the patients complain of scarcely any symptoms of asthenopia, and where formerly a tenotomy would not have been thought of; but the end to be gained, and the dangers to be warded off by the operation, fully justify the measure. If I have succeeded in drawing the attention of the profession to the importance of muscular insufficiency as a cause of progressive myopia, a fact first established by Von Graefe, and rightly regarded as one of his most brilliant contributions to ophthalmic literature, the object of this paper will be more than accomplished.

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